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Editorial

THE TOTALISATOR AS AN AID TO VETERINARY SCIENCE.

In a previous issue of the Veterinary Journal (December, 1928) attention was drawn in an Editorial to an article by the Special Commissioner of the *Sporting Life*, which drew attention to a suggestion which was brought before the Council of the Thoroughbred Breeders' Association by Mr. Edmunds, the Manager of the Mentmore Stud, " that some at least of the surplus profits from the Totalisator (if and when there are any) should be applied to the foundation of scholarships for young veterinary surgeons, who are prepared and equipped to devote themselves to research work in connection with the diseases of animals in general and horses in particular."

It will be pleasant reading to the members of the veterinary profession to know that at another meeting of the same Association held only a few days ago the subject was again discussed and our cause was championed by Viscount D'Abernon, the Chairman, who personally pressed home the suggestion that a certain proportion of the profits of the Totalisator should be set aside each year " for Veterinary Research." If the Council of the Thoroughbred Breeders' Association

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agree to this course it will be a very great help and encouragement to a very necessary and deserving cause, for it is only the lack of financial help which is holding things back. The workers can be found if only the financial side can be satisfactorily arranged, and the owners of valuable bloodstock, whose losses from preventable diseases amount to tens of thousands of pounds annually, will reap the reward of their generosity in the increase in the health of their valuable animals and the lessened mortality from preventable disease.

In his speech Lord D'Abernon said :

" The most important event of the year affecting racing and horse breeding has been the introduction of the totalisator. It is too soon yet to judge of the ultimate result, but experience gained during 1929 goes far to confirm the view of those who held that the introduction of the totalisator will lead to better racecourses, better stands, and larger prizes.

" In the last year during which betting was taxed the total turnover on racecourse betting which came under review by the taxation authority amounted to 45 millions a year. Even the most fervent believer in the disagreeable efficiency of the taxing authorities will not believe that this was the full amount. A large amount of betting undoubtedly went on without making itself subject to taxation. Suppose this betting amounted to 50 per cent. of the taxed amount, it would bring us to a total of 67½ millions.

" Apart from betting on the course, there is betting off the course. Many of the witnesses who gave evidence before the House of Commons Committee in 1923 estimated the off-the-course betting as equal to seven or eight times the money betting on the course. I will not take so high an estimate. Suppose it is three times the amount ; that would give a total of 200 millions sterling, which, added to the approximately 67½ millions of on-the-course betting, makes a total of 267½ millions.

" If the figures which I have suggested as a possible basis are realised, the question is in what way can the amounts available be best directed to help the interests of thoroughbred horse-breeding ? We discussed the question last year, and opinion appeared to be that thoroughbred breeding would benefit adequately by the indirect effect of the improvement of racing conditions generally—better prizes, smaller entrance fees, and an increased public attendance.

" I feel, myself, that we should do wisely to press for increased attention to veterinary research. Horses suffer from complaints that are still very obscure, the remedy for which is still unknown to science.

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Apart from research, I am not sure that more liberal support is not due to the whole science of veterinary medicine and veterinary surgery. If these views are generally held, we might do well to approach the Racecourse Betting Control Board regarding them."

We are grateful to our friends on the Thoroughbred Breeders' Association Council and can promise that if their scheme materialises and they, on their part, will find means to supply the financial support, we of the veterinary profession will find the workers ; and we will do our utmost to " run to earth " the causes of some more of these troublesome diseases of thoroughbred stock whose eradication is so necessary.

It is not only, however, with thoroughbred horses that the need is felt and one wonders why the disgrace continues—*for it is a disgrace, a national disgrace, that Great Britain, the home and market of the world for pedigree stock of all kinds, should lag so far behind in its appreciation for the value of Veterinary Science.* One wonders what would happen to the stock of the country—and this means to the country itself—if the veterinarian went on strike and refused to do his job. Epidemics of all kinds would appear amongst the cattle and horses, and there would soon be chaos and bankruptcy, *for the backbone of a country is its agriculture, and the backbone of agriculture is its animal population ; whilst the prosperity of the animal owner depends upon the maintenance of good health amongst his stock, and the health of the stock depends upon the advice given by the only man qualified to diagnose and treat the diseases of animals—i.e. the veterinarian.*

Not only is more research needed upon the diseases of thoroughbred horses but the same can be said about every species of animal. Mr. Stephen Lethbridge, the Managing Director of Messrs. Spratts, through the instrumentality of the National Dog Week Council, has collected the sum of £20,000 for the purpose of investigation into the means whereby suffering can be alleviated in the case of diseases of dogs ; and the Agricultural Correspondent of the *Times,* in an article which appeared only a few days ago, calls urgent attention to the need for veterinary research into the cause and treatment of certain pig diseases, especially swine fever, which has increased enormously lately and bids fair to get out of control unless tackled with a firm hand. In the *Times* for January 20th, the following paragraph appears in a prominent place, and, as we have already done to Lord D'Abernon and the Council of the Thoroughbred Breeders Association, we desire to express our gratitude to the Agricultural Correspondent of the *Times* for drawing attention to what is really a very urgent and serious matter :

" Farmers are supposed to be lacking in appreciation of scientific

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research and experiment. Last week they were simply shouting for renewed and suitable research into the problems that are impeding the way to success in the breeding and raising of pigs. Swine fever has so far defied the authorities to control it, and, while the fundamental knowledge concerning the disease is still lacking, our premier Veterinary College is on the point of collapse and is in every sense unfitted to carry on the class of work for which it was intended and which is so urgently needed. *No country in the world has greater need of veterinary research than England, since nowhere else is there live stock of equal value to be cared for,* and yet there was presented at the great meeting of farmers last week the spectacle of herds of pigs being decimated *while our greatest centre of veterinary research was in a state of fast decay."*

The italics are ours, for unfortunately, they are only too true—and, although we must not be too impatient, and we have to recognise that the attention of our Ministers must first be given to other things of more importance than veterinary research, yet we wonder when our turn will come; *and whether, if it does not come soon, it may not be too late. The decision to be made is of so momentous a character that upon it depends the education of the major portion of the profession in the future.* Let us hope that it will be considered soon.

General Articles

MISCELLANEOUS EXPERIMENTS WITH ANTHELMINTHICS, CHIEFLY ALKYL-CHLORIDES, IN THE TREATMENT OF NEMATODE INFESTATIONS OF SHEEP.

By R. DAUBNEY, B.Sc., M.R.C.V.S.,
Assistant Chief Veterinary Research Officer, Kenya Colony.

A SHORT tour of the sheep-farming districts of Kenya by the writer served to demonstrate that by far the most serious pest of sheep in this country is the common sheep-hookworm, *Bunostomum trigonocephalum*. This parasite has undoubtedly been responsible for the heaviest losses among sheep of all ages, but particularly among lambs and yearlings. Most outbreaks of hookworm disease commence when lambs are from 4 to 6 months old ; and lambs born in a May lambing-season are much more liable to severe infestation than those born in October. Indeed, it has not been uncommon to find that the whole crop of May lambs has been destroyed by the ravages of this parasite during the first year of life. More generally perhaps one finds the mortality in a heavily-infested lamb-flock to be anything from 30 per cent. to 70 per cent. ; but natural recovery from the disease is extremely slow, and in the case of animals that have been heavily infested and have recovered gradually, there is always marked stunting of growth, the animals remaining undersized and badly developed all their lives. So marked is this stunting that the writer had no difficulty in picking out from a mixed flock of gimmers every animal that had been drafted from a lamb-flock that had suffered from severe hookworm disease more than eighteen months previously.

Control measures based upon knowledge of the life-history of the parasite have been instituted and have proved very successful when energetically applied, but occasionally pasture conditions are such that the necessary rotation of flocks cannot be faithfully carried out, and heavy infestation takes place, usually during rains following a prolonged drought. It is necessary, therefore, to have as part of the flock-owners' equipment against loss, a suitable anthelminthic for the treatment of infested sheep.

Of the many drugs that have been recommended as anthelminthics against the hookworm group in various host-species carbon-tetrachloride has been the most generally successful, in spite of the occasional fatalities that have occurred. Some doubts were at first experienced about the desirability of administering such a highly volatile and toxic

drug to ruminants, but Hall gave sheep up to 48 cc. without ill-effects and with considerable anthelminthic efficacy. Following Hall, the writer in 1922, administered the drug by stomach tube in doses of from 10—15 ccs. during a small outbreak of helminthiasis among sheep in Surrey, England, in which hookworms were present in fairly large numbers. More recently Montgomerie (1925 and 1926) and Norris (1926) have been making use of carbon-tetrachloride capsules in the treatment of liver-rot in Wales and Ireland, a treatment recommended originally by Floris (1907); but the treatment has been responsible for considerable mortality in certain cases. Liver-fluke in Australia is also being treated by the administration of carbon-tetrachloride in soft gelatine capsules. The dose generally employed in the treatment of liver-rot is small, usually a single dose of from 1 cc. to 2 cc. in capsule. Attempts to utilise carbon-tetrachloride as an anthelminthic for cattle have not been successful. (Sheather 1926.)

The experiments in Kenya were commenced in 1925 and were continued as infested animals became available. Some of the results were very briefly recorded in the Annual Reports of the Department of Agriculture, Kenya Colony, 1925 and 1926. A few preliminary observations were carried out upon the manner in which drugs pass to the fourth stomach when given by different methods. These experiments were directed more particularly towards a comparison between drenching and administration by stomach-tube or gelatine capsule.

Administration of Fuchsin in Soft Gelatine Capsules.

Ten sheep were fasted 18 hours and were each given a soft capsule containing a strong solution of acid fuchsin. The sheep were killed 30 minutes after the administration of the dye and a search was immediately made for the capsules. In all ten animals the capsule was found in the rumen, in two cases in the right dorsal sac and in the remaining eight close to the entrance to the reticulum. All the capsules were open and there was diffuse staining of the contents of the rumen in all the animals. No stain could be detected in the reticulum, omasum, or abomasum of nine of the sheep. In two of the ten the capsule had reached the fundus close to the entrance to the reticulum and in one of these two there was faint staining of the ingesta in the reticulum; the other compartments of the stomach were free from dye. A further batch of ten sheep was treated in similar fashion. The dye was administered in soft gelatine capsules after fasting eighteen hours, but this time an interval of two hours was allowed to elapse before the animals were killed. All ten capsules were found open in the rumen and in no instance was there any staining of the contents of the reticulum, omasum, or abomasum.

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Drenching with Solution of Fuchsin.

Ten sheep were drenched slowly and carefully with 100 ccs. of the solution of Fuchsin. The sheep were killed in two batches, five after fifteen minutes' interval and five after thirty minutes. Staining of the contents of the rumen was fairly evenly distributed throughout the contents of the rumen in all ten cases, with a more intensely-stained area in the right dorsal sac. In no case was there any staining of the reticulum, omasum, or abomasum.

Ten sheep were drenched rapidly with 100 ccs. of the solution of Fuchsin, no notice was taken of coughing, and the animals struggled more or less violently. They had been fasted for eighteen hours. Five of these animals were killed after an interval of fifteen minutes and five after thirty minutes. In the five animals killed after fifteen minutes there was fairly-even light staining of the rumen content in every case. In one sheep there was heavy staining of the abomasum, with isolated patches of the deepest colour on the mucous membrane of the omasum and in the material lying adjacent to these patches. The remainder of the mucous membrane of the omasum and its contents were unstained. The contents of the reticulum in this animal were stained to approximately the same degree as those of the rumen. A second animal in this batch showed faint staining of the mucous membrane and adherent contents towards the cardiac end of the abomasum, no staining of the omasum or its contents, and staining of the contents of the reticulum to a degree slightly less than that of the rumen content.

In the five animals killed after an interval of thirty minutes the rumen content was fairly evenly but lightly stained. One animal showed deep staining throughout the surface of the abomasum, no staining of the omasum, and a faint staining of the reticulum, about equal in intensity to that of the rumen. In the remaining animals of this group, there was no trace of staining elsewhere than the rumen.

Administration by Stomach Tube.

Ten sheep were dosed by means of an ordinary length of pressure rubber tubing, of $\frac{5}{8}$ in. section, provided with a funnel. The tube was passed into the œsophagus only. The animals were killed thirty minutes after dosing, since this period was more convenient and the observations on drenching recorded above suggest that during a period of two hours little or no alteration takes place in the distribution of the material forming the drench, which is found on *post-mortem* examination in the position it reached during the actual process of administration.

The staining in all ten animals was diffuse and fairly evenly distributed throughout the contents of the rumen. The contents of the

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reticulum were also faintly stained in eight of the ten animals. No traces of stain could be detected in the omasum or abomasum.

A second batch of ten sheep was treated by passing the stomach-tube to its fullest possible extent and at once throwing the solution down the funnel. Most of the sheep struggled a little. The animals were killed after an interval of thirty minutes. In all the rumen was lightly but equally stained throughout, and the reticulum and its content were stained with an intensity about equal to that of the rumen. In all ten animals the omasum and abomasum showed staining. In the omasum the dye was present (apparently almost undiluted) in isolated deeply stained areas of the mucous membrane and in the ingesta adherent to these areas. The abomasum and its content showed slightly less intense staining than the rumen in four of the animals, approximately equal staining in four others ; and in the remaining two animals very intense staining, while the rumen in these two cases was definitely more lightly stained. These observations were repeated in a further batch of twenty animals, half of which were dosed by stomach-tube passed approximately halfway and half by tube passed to its fullest extent.

The interval before slaughter was in this instance extended to one hour. The results were substantially the same. In none of the animals drenched through the partially-passed tube was there any staining of the omasum or abomasum, while in every animal of the other batch both omasum and abomasum contained quantities of the dye. The staining of the omasum in every case was of the patchy, intense variety, while the staining of abomasum was diffuse, varying in intensity from slightly less than or about equal to that of the rumen in six animals, to a definitely deeper tint in the remaining four animals. The results of these trials are summarized in Table I.

Table I.

Method	Number of animals employed	Interval	Detection of Dye in Divisions of Stomach			
			Rumen	Reticulum	Omasum	Abomasum
Soft Capsule	10	30 mins.	10	2 faintly	None	None
Soft Capsule	10	2 hrs.	10	None	,,	,,
Drenching slowly	5	15 mins.	5	,,	,,	,,
,, ,,	5	30 ,,	5	,,	,,	,,
,, rapidly	5	15 ,,	5	2	1	2
,, ,,	5	30 ,,	5	1	None	1
Stomach tube in œsophagus only	10	30 ,,	10	8 faintly	,,	None
,, ,,	10	1 hr.	10	10 ,,	,,	,,
Stomach tube fully passed	10	30 mins.	10	10	10	10
,, ,,	10	1 hr.	10	10	10	10

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These results are roughly in agreement with those of Veglia (1918), in so far as their scope was covered by his work. Veglia found that in normal drenching liquids in amounts from 10 to 140 cc. pass " in bulk " to the anterior dorsal blind sac of the rumen and to the reticulum. Liquids swallowed voluntarily also pass to the anterior dorsal sac of the rumen and to the reticulum. The passage of liquids directly from the œsophagus to the abomasum, either in fractions or in bulk he considered to be an accidental deviation from the normal stream of ingested fluid, as a result of forced deglutition. Direct passage to the abomasum occurred in 14 per cent. of the sheep drenched by Veglia. Taylor (1927) records strikingly different results in his observations on seven sheep. Of six sheep to which drenches, varying in quantity from one to eight fluid ounces, were given the solution was found to have reached the abomasum in every animal. His results in the drenching of cattle are, however, almost identical with those obtained by Veglia in the drenching of sheep, that is to say, the fluid passed normally to the rumen and reticulum, reaching the abomasum only in a comparatively small proportion of the animals drenched (23 per cent. or three in all). Since Taylor used the same wine bottle for drenching both sheep and cattle, it is possible that his liquids were administered to sheep at a rate which forced them to a hurried deglutition ; the fact that in a somewhat high percentage of the cattle drenched the fluid passed directly to the abomasum may indicate that the rate of administration was high even for cattle. In the experiments recorded here all animals were dosed in the standing position and the bottle used was an ordinary small soda-water bottle. With regard to the results of administration by stomach-tube Taylor records one case in which 4 ozs. of fluid was given through the stomach-tube. The liquid passed to the rumen and reticulum only. It is not stated to what extent the tube was passed. The results of administration by soft gelatine capsule are in fairly close agreement with those obtained by Veglia with pills. The capsule or the pill always passes to the rumen and in the case of the former opens there within thirty minutes of administration.

It is evident that the stomach-tube passed to the fullest extent, possesses distinct advantages over the soft gelatine capsule in the rapidity with which the drug is carried to the fourth stomach and the degree of dilution that takes place. Where a highly volatile substance such as petroleum-ether is used administration by stomach-tube should also be less likely to produce tympany of the rumen. The writer has found this to be the safest and most useful method of administering carbon-tetrachloride. A solution of magnesium sulphate can be given immediately after the drug without removing the tube ; and dos-

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age can be more readily varied for animals of different weight than when use is made of soft gelatine capsules.

The Efficacy of Carbon-tetrachloride against Hookworms and Nodular Worm.

Hall and Shillinger (1923) gave carbon-tetrachloride in doses of 4, 8, 15 and 30 cc. to four sheep lightly-infested with hookworms, without fatality and with 100 per cent. efficacy. They have also given sheep up to 48 cc. without ill effects. Tables II, III, and IV summarise the results of the administration of carbon-tetrachloride to sheep by the following methods.

Table II. By stomach-tube without a purgative. Table III. By soft capsule without a purgative. Table IV. By stomach-tube with a purgative.

In Table II the efficacy of the drug against hookworm in doses of from 0.1 cc. to 0.2 cc. per lb. body weight varies from 91.6 per cent. to 100 per cent. Four animals out of nine died as a result of the administration, two during the first 48 hours and two between the fourth and sixth days. Of the animals that died two had received the largest dose of the drug, 0.2 cc. per lb. : two of them had extremely heavy infestations, and the remaining two moderate infestations. Of the animals receiving the largest dose two of the four survived, and of those receiving the smallest dose two out of the three. There was no efficacy against other species of parasites, although some of the animals had quite large infestations of *Ostertagia* or *Trichostrongylus*.

In Table III are shown the results of the administration of small doses of CCl_4 by soft gelatine capsule to adult sheep, only lightly-infested with hookworm. A single dose of 3 cc. gave an efficacy of 100 per cent. in each of three animals, weighing 50 lbs., 30 lbs. and 48 lbs. respectively. A dose of 2 cc. varied in efficacy from 76.5 per cent. to 90 per cent., while a dose of 1 cc. was only 26.1 per cent. efficacious on the one occasion that it was tried. It appears that the dose cannot be reduced below 3 cc. without impairment of the anthelminthic efficacy. There were no fatalities among the eight animals included in Table III ; a result which may be ascribed partly to the better and more robust condition of the animals, which were on the average considerably heavier than those used in series II ; partly to the smaller dose employed ; and partly to the fact that extensive lesions produced by the bites of the hookworm were not present in the small intestine.

A further point of interest is the presence of fairly heavy infestations with *Œsophagostomum columbianum* in five of the animals. Out of a total of 100 nodular worms in five animals the drug succeeded in removing seven only.

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Sheep 2954 receiving 2 cc. of the drug passed seven scolices of *Avitellina*, an efficacy of 100 per cent. Carbon-tetrachloride commonly shows a high efficacy against tapeworms of this genus.

Table IV gives the results of administration of carbon-tetrachloride by stomach-tube in doses equal to those shown in Table II. The animals in Table IV, however, received also three ounces of magnesium sulphate in saturated solution. The salt was given by stomach-tube immediately after the carbon-tetrachloride. Fourteen animals received doses of either 0.1 cc. per lb. bodyweight, or 0.2 cc. per lb. bodyweight. Nine of the animals had heavy infestations with *Bunostomum* and showed marked clinical symptoms of hookworm disease, yet there was not a single fatality. The efficacy of the drug varied from 98.2 per cent. to 100 per cent., slightly better results being achieved with the smaller dose, at which the efficacy never fell below 100 per cent. This result is in complete accord with the observations of Hall and Shillinger (1924) and (1925) upon the action of magnesium sulphate in reducing the toxicity of carbon-tetrachloride to dogs.

It is probable that sheep heavily-infested with *Bunostomum* are more liable than normal sheep to poisoning by carbon-tetrachloride, on account of the presence of large numbers of breaches in the intestinal mucous membrane where hookworms have been attached. Simultaneous administration of Epsom-salts with the carbon-tetrachloride will protect such sheep against poisoning, even though the animals may be in extremely poor condition. Healthy sheep may be given extremely large doses of carbon-tetrachloride with complete safety when magnesium sulphate is also administered. Hall and Shillinger (1923) have given a sheep as much as 48 cc. without producing any symptoms; and the writer has given 45 cc. to a sheep weighing 79 lbs., which represents approximately seven times the amount of the dose that has been recommended on the basis of these experiments, namely 0.1 cc. per lb. bodyweight.

Other Halogen Compounds.

A comparison of the anthelminthic properties of chloroform, carbon-tetrachloride and other halogen compounds may lead one to the conclusion that anthelminthic efficacy in this group is in all probability related to high halogen content. This was the conclusion reached by Cams and Mhaskar (1920) and the assumption that induced Hall (1921) to test the anthelminthic activity of carbon-tetrachloride; and subsequently of other halogen compounds. In fact, however, there is little doubt that a more potent factor in the determination of anthelminthic efficacy in this group is solubility, as was pointed out by Hall and Cram (1925).

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Tetrachlorethylene.

Tetrachlorethylene (C_2 Cl_4) was introduced in 1925 by Hall and Shillinger, who found it to be slightly more effective than carbon-tetrachloride against the hookworms of the dog, in spite of the fact that it contains only the same amount of chlorine in a heavier molecule. Its solubility is approximately 1 : 10,000 or roughly eight times less than that of carbon-tetrachloride. Table V summarizes the results of administration of tetrachlorethylene to eight sheep, all of which were carrying some hookworms, three being heavily-infested. The doses used, namely 0.1 and 0.2 cc. per lb. bodyweight, correspond roughly in chlorine content to equivalent doses of carbon- tetrachloride. In the heavily infested animals of this series, 2591, 2600, A11 and A12, this dose removed 223 out of a total of 1023 hookworms, or approximately 22 per cent. Its efficacy in individual animals varied from a maximum of 100 per cent. in a very light infestation. A2 (5 hookworms), or 95 per cent. in a heavier infestation 2600, (103 hookworms) : to a minimum of 9.3 per cent. in A11, a heavy infestation, or even of 0 per cent. in a light infestation 2969 (2 hookworms). Its efficacy against the hookworms of sheep is therefore considerably less than that of carbon-tetrachloride. Against other species of worms no efficacy was shown. There were no symptoms in any of the animals killed on the fourth day after dosing. The remaining animals were treated with carbon-tetrachloride and the worms during four days were collected before they were destroyed for examination.

Tetrachlorethane. $C_2H_2CL_4$ ($CHCL_2$ $CHCL_2$).

This compound, a third member of the group, which is considerably more soluble than carbon-tetrachloride (1 : 750 parts water) was subjected to a preliminary test for toxicity on one animal. As was expected it proved to be a potent poison, acting on the respiratory system.

Sheep 2809, weighing 33 lbs., received 3.3 cc. by stomach-tube together with three ounces of Epsom salts in saturated solution. No symptoms were observed for 23 minutes, when the animal showed some lack of co-ordination in movements, accompanied by an increase in the frequency of respiration. Forty-four minutes after receiving the dose the animal went down and remained more or less comatose until death supervened, apparently from respiratory paralysis, seven hours after the administration. The heart continued to beat some minutes after respiration had finally ceased. *Post-mortem* examination revealed acute gastritis and congestion of the lungs.

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Kudicke and Weise (1926) tested the toxic properties of this drug *in vitro* for the larvæ of *Strongyloides*. As a vapour Tetrachlorethane was one of the three most active of the compounds tested and gave better results than any other chlorine compound. In watery solution it again proved to be among the most active, although in this instance it was only about half as active as tetrachlorethylene. It is, however, obviously unsuitable for medicinal purposes.

Pentachlorethane. C_2HCL_5 ($CHCL_2\,CCL_3$).

Pentachlorethane which is highly soluble in water appeared likely to prove extremely toxic and was accordingly tested on two animals that had already been treated with CCL_4, and which were about to be sacrificed for *post-mortem* examination.

Sheep 2612 weighing 24 lbs., aged eight months, was emaciated and suffering from abdominal ascites as a result of a heavy hookworm infestation that had been treated eight days previously with carbon-tetrachloride. This animal was given by stomach-tube 5.6 cc. of pentachlorethane at a dose-rate of 0.233 cc. per lb., bodyweight, corresponding in halogen content to a dose of 0.2 cc. per lb. of carbon-tetrachloride. Immediately after receiving the dose the animal staggered a little, and in a few seconds fell. Complete anæsthesia was established within three minutes and respirations became very slow, with gradually increasing intervals of complete cessation. Respiration finally ceased in 7 minutes, although the heart continued to beat for a further period of four minutes. A *post-mortem* examination was immediately performed. The body was completely relaxed, and on opening the chest cavity a strong odour of pentachlorethane was noticed. There were no macroscopic lesions in the alimentary canal or in any of the organs, even the lungs appearing normal. A large number of *Ostertagia circumcincta* (726) was collected from the abomasum and five nodular worms (*Œsophagostomum columbianum*) from the large intestine. All the worms were alive.

Sheep 2624, weight 24 lbs., also suffering from hookworm-disease until treatment with carbon-tetrachloride seven days previously, was also given 5.6 cc. of pentachlorethane by stomach-tube. Symptoms of inco-ordination were manifested one and a half minutes after the animal received the drug, and complete anæsthesia was established in eight minutes. Respirations were slow, with intervals of complete failure. Consciousness was not regained, although the animal continued to breathe for 45 minutes. The heart ceased with the respirations. On *post-mortem* examination there was again the strong odour

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of the drug, and in this animal faint congestion of the cardiac end of the abomasum was the only lesion observed.

Hexachlorethane. C_2CL_6.

This compound, a very light crystalline solid, is the most insoluble of the compounds tested (less than 1 : 10,000). A quantity of the compound was prepared for the writer in 1925 by Mr. V. A. Beckley, Agricultural Chemist, Kenya Colony, and it was administered in hard capsule in the first instance in a dose of 0.25 grammes per lb. body-weight, which corresponds approximately in halogen content to a dose of 0.2 cc. per lb. body-weight of carbon-tetrachloride. With the first sample prepared a very high anthelminthic action was obtained against hookworms, 99.6 per cent. of a total of 526 hookworms being removed from sheep 2603. The dose per pound body-weight was then reduced to one half the amount, sheep 2590 and 2606 receiving the drug at the rate of 0.125 gramme per lb. The lower dose proved to be 31 per cent. and 51.7 per cent. effective against hookworms in these two animals. A further reduction of the dose to 0.0625 gramme per lb. lowered the efficacy of the treatment to 2.1 per cent.

The remaining four animals in Table V were treated with another sample of hexachlorethane obtained in the usual manner from British Drug Houses Ltd., which proved to have a considerably lower efficacy against hookworms. The results of treatment with this sample are much more in accordance with those of Hall and Cram (1925) who found hexachlorethane to be useless as an anthelminthic for dogs. It is possible that the high efficacy of the first sample was related to the presence of some impurity in the compound, and the experiments will be repeated with the view of discovering if this was the case, and if so what was the compound responsible.

Trichlorethylene. $CHCL : CCL_2$.

Of the trihalogen group chloroform has long been known as an anthelminthic of value, but the careful experiments of Hall and his collaborators have shown that it is considerably less efficacious than carbon-tetrachloride or tetrachlorethylene, particularly against parasites of the hookworm group. Trichlorethylene with a volatility slightly less than that of carbon-tetrachloride has a solubility of about 1 : 1,000 or slightly greater than carbon-tetrachloride. Hall and Cram suggest that a solubility of about 1 : 1,200, i.e. approximately that of carbon-tetrachloride, is a desirable feature in an anthelminthic ; striking, so to speak, the happy medium between the parasite and the host. In the experiments of Kudicke and Weise, already mentioned,

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trichlorethylene was approximately three-quarters as efficacious as tetrachlorethane in watery solution ; as a vapour it was considerably less efficacious.

Trichlorethylene was tested by administration to two sheep, Nos. 2602 and 2622. It proved to be an extremely potent and rapid respiratory poison.

Sheep 2602, weight 24 lbs., aged 8 to 9 months, received by stomach-tube 4 cc. of tetrachlorethylene at a dose-rate of 0.16 cc. per lb. body-weight, equivalent in chlorine content to carbon-tetrachloride at the rate of 0.2 cc. per lb. Symptoms of inco-ordination were manifested immediately the animal was released after drenching. Anæsthesia was complete in two and a half minutes, with the respiration rate decreasing rapidly. Respirations ceased in four and a half minutes, the heart continuing to beat for a further period of fourteen minutes. At the *post-mortem* examination, twenty-minutes after the dose had been administered, there was a strong odour of trichlorethylene from the chest cavity. No lesions were found.

Sheep 2622, weight 20 lbs., aged 4 to 5 months, received 3.2 cc. of tetrachlorethylene by stomach-tube, also at the rate of 0.16 per lb. body-weight. Inco-ordination was noticed within two minutes and anæsthesia was complete in seven minutes. The respiration rate was markedly lowered with intervals of cessation, but the animal lived for a further 40 minutes after becoming anæsthetised. The heart did not beat after respirations had ceased. There were no lesions and again there was a strong odour of the drug from the chest cavity.

In spite of the fact that the solubility of trichlorethylene is only a little greater than that of carbon-tetrachloride, intoxication takes place with extreme rapidity. In this respect trichlorethylene resembles pentachlorethane and tetrachlorethane. The progress of intoxication in these cases was in every way similar to that in an acute case of poisoning by carbon-tetrachloride (Carman 1926).

Sodium Trichloracetate.

This compound was tested by administration to three sheep, Nos. 2601, 2609 and 2796.

Sheep 2601, weight 33 lbs., aged 15 months, suffering from hook-worm disease, was given 12.8 grammes of sodium trichloracetate in a hard gelatine capsule, the dose-rate being 0.385 grammes per lb., body-weight, equivalent roughly to 0.2 cc. per lb., of carbon-tetrachloride. During the four days following treatment this animal did not pass any worms. Treatment with carbon-tetrachloride seven days later removed

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327 hookworms (see Table IV). None were left at *post-mortem* examination, and the only other parasites collected were 82 *Ostertagia circumcincta,* which had been unaffected by either treatment. The fourth stomach showed a large area of catarrhal gastritis.

Sheep 2609, weight 47 lbs., aged 12 months, received 18 grammes of sodium trichloracetate by hard capsule, the dose-rate being the same as that employed for sheep 2601. On the four days succeeding treatment this animal passed one hookworm ; one scolex and numerous fragments of *Avitellina* ; one scolex and fragments of *Avitellina ;* one hookworm and one nodular worm respectively, a subsequent treatment with carbon-tetrachloride removed 61 hookworms and none were left at *post-mortem* examination. No more tapeworms were passed after the administration of carbon-tetrachloride and none remained at *post-mortem.* There were 132 *Trichostrongylus* and 47 *Ostertagia* unaffected by both treatments (see Table IV). No nodular worms were found, the first treatment having removed the only one present. There was again a marked gastritis which was attributed to the sodium trichloracetate.

Sheep 2796, weight 33 lbs., aged 12 months, known to be heavily infested with *Hæmonchus* and nodular worms, was selected for a further test of this drug, in view of its action in removing a single nodular worm from sheep 2609. The dose given to this animal was 16.5 grammes in hard capsule, the dose-rate being increased to 0.5 grammes per lb. body-weight.

On the first day after treatment this animal passed one *Hæmonchus* and many fragments of *Avitellina* ; on the second further fragments of *Avitellina* ; on the third and fourth days nothing. The animal died on the morning of the fifth day. At *post-mortem* examination there was considerable inflammation of the mucous membrane of the abomasum with numerous submucous hæmorrhages; the inflamed area extended for about 12 in. along the duodenum. The following parasites were collected from the stomach and intestines, 1237 *Hæmonchus,* 172 *Bunostomum* and 242 *Œsophagostomum columbianum.* There were no Cestodes. The lesion of the fourth stomach and duodenum was no doubt the cause of death.

Sodium-trichloracetate is therefore useless as an anthelminthic against hookworms, stomach worms and nodular worms. It removes *Avitellina,* but so also does carbon-tetrachloride. Administration of this drug to sheep causes a gastritis, which may prove fatal.

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Ethyl Trichloracetate.

Ethyl trichloracetate was tested on one animal only, and did not prove of any value.

Sheep 2794, weight 37 lbs., received by stomach-tube 3.7 cc. of ethyl trichloracetate at the rate of 0.1 cc. per lb. body-weight. During the first three days after treatment this animal did not pass any worms. On the fourth day two nodular worms (*Œsophagostomum columbianum*) were passed. This animal was subsequently treated with tetrachlorethylene, which removed 24 *Hæmonchus* and 19 *Œsophagostomum* out of a total of 24 *Hæmonchus* and 152 *Œsophagostomum*. There were in addition 36 *Bunostomum* unaffected by either treatment. There were no lesions that could be ascribed to the treatment.

Paradichlorobenzene.

This compound which is in general use as an insecticide was tested on one animal only; it did not show any promise of anthelminthic value.

Sheep 2610, weight 49 lbs., aged 18 months, suffering from hookworm disease, received 5 grammes of paradichlorobenzene in a hard gelatine capsule, the dose-rate being 0.1 cc. per lb. body-weight. On the first, second and fourth days after the treatment no worms were passed, on the third day this animal passed three *Bunostomum*. A treatment with carbon-tetrachloride seven days later removed 267 hookworms and none were left *post-mortem*. The treatment with paradichlorobenzene was therefore only something over 3 per cent. effective against hookworms. In addition to the hookworms there were 498 *Ostertagia circumcincta* and three *Trichuris* which were unaffected by either of the treatments. No lesions were found *post-mortem*.

Copper Sulphate and Tobacco.

Guberlet has reported 100 per cent. success in the treatment of hookworms in sheep by means of a 1 per cent. solution of copper sulphate, mixed with an infusion of tobacco. Many of the animals utilized in these experiments in Kenya had been regularly treated with government wire-worm remedy consisting of copper sulphate and arsenic, with evident success so far as concerned the control of the wireworm or stomach worm, *Hæmonchus contortus*, but without any apparent action on the course of the hookworm disease.

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It was decided, however, to test the value of the copper sulphate and tobacco infusion prepared according to Guberlet.

Sheep 2608, weight 31 lbs., aged 8 to 9 months, suffering from hookworm disease, was given by stomach-tube 50 ccs. of a 1 per cent. solution of copper sulphate in a 1 per cent. watery infusion of tobacco. During the four days following treatment no worms were passed. After treatment with turpentine and linseed oil, this animal was given a further treatment with carbon-tetrachloride, which recovered 705 hookworms, leaving eight alive in the small intestine. 13 nodular worms and 6 whipworms were unaffected by all three treatments.

Turpentine and Linseed Oil.

This mixture, which has frequently been recommended for the treatment of intestinal helminthiasis in sheep and which is reputed to be effective against hookworm, was administered by stomach-tube to sheep 2608 five days after the treatment with copper sulphate and tobacco. The dose employed was two ounces of turpentine in three ounces of linseed oil. No worms were passed after this treatment although the animal had 713 hookworms, 13 nodular worms and 6 whipworms.

Oil of Chenopodium.

When administered by the mouth oil of chenopodium is considerably inferior to carbon-tetrachloride as an anthelminthic for hookworms and it does not remove nodular worms. Lambert, however, suggested that it might be employed intravenously as a treatment for whipworms, and recorded successes in the removal of this species by the method. More recently Fernan-Nunez has reported successful treatment of whipworm and oxyurid infestations in man by this method.

Intravenous injections of oil of chenopodium were given to five sheep with the object of ascertaining whether the drug exercised any action on nodular worms or hookworms when given by this route.

Sheep A14, weight 40 lbs., aged 12 months, known to be heavily infested with nodular worm was given an injection into the jugular vein of 1.5 cc. of undiluted oil of chenopodium, the dose recommended for man. The animal showed considerable distress immediately it was released and was thrown into convulsions in less than one minute. It was unable to rise and lay completely unconscious with the head thrown back and the lips drawn away exposing the teeth. Death took place in twenty-three minutes. *Post-mortem* examination revealed acute congestion of both lungs with innumerable petechial

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hæmorrhages. The lungs and chest cavity smelt strongly of chenopodium.

Sheep A16, weight 38 lbs., was treated at the same time as A14 with a smaller dose, 1 cc. This animal displayed the same symptoms and lesions and died in 35 minutes.

A second sample of oil was obtained and the experiment was repeated, this time using larger and stronger animals.

Sheep 3019, weight 81 lbs., aged two and a half years, received 1 cc. of the oil slowly into the jugular vein. Immediate distress was occasioned, respirations increasing to 110 to 130 per minute. The animal stood with nostrils distended and head depressed. Defæcation occurred two minutes after the treatment, and from then at frequent intervals during the next three hours. At the first two or three defæcations pellets were passed, but later the fæces became quite watery in consistence. By the fourth hour the respiration rate had decreased to about 60 and the animal had ceased to purge. For the next two days it refused food and rapidly lost condition. The respirations, however, continued to improve steadily and by the end of a week the animal was again normal. No worms were passed in the fæces during the four days after treatment, but at *post-mortem* examination on the eighth day none was discovered in the alimentary tract.

Sheep 3021, weight 42 lbs., aged 15 months, and sheep 2969, weight 45 lbs., each received an intrajugular injection of 1 cc. of oil of chenopodium mixed with 4 cc. of olive oil. There was evidence of immediate distress and respirations increased to 80 per minute. Defæcation was frequent for between two and three hours, by which time the animals appeared normal except for a respiration rate of 30 to 40. No worms were passed by either of these animals during the next four days, although at *post-mortem* examination sheep 3021 had 17 hookworms and 43 nodular worms. Sheep 2969 was treated with carbon-tetrachloride which removed two hookworms (Table III), and at *post-mortem* had no hookworms, 178 nodular worms, and 7 stomach worms. The treatment had been entirely ineffective against hookworms and nodular worms.

Summary.

Drugs administered to sheep by drenching pass in bulk to the rumen, and do not reach the abomasum and small intestine for some considerable time after ingestion.

Capsules pass to the rumen, and open in that division of the stomach.

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The contents of both drenches and capsules are therefore subjected to a high degree of dilution before reaching the abomasum or small intestine.

Drugs administered by stomach-tube, passed into the œsophagus only, pass in bulk to the rumen, as in the case of drenches; when, however, the stomach-tube is passed to its fullest extent a large proportion of the dose reaches the abomasum direct. It is suggested that this method should prove useful in the administration of anthelmintics. When a volatile compound such as petroleum-ether is employed, there is less risk of causing tympany of the rumen if this method of dosing is followed.

Carbon-tetrachloride alone administered by stomach-tube proved to be from 91 per cent. to 100 per cent. efficacious against hookworms in a single dose at a dose-rate of 0.1 cc. per pound body-weight. At this dose the drug killed four animals out of a total of nine tested (Table II). Smaller doses of CCl_4 given in soft gelatine capsules produced no fatalities. A single dose of 3 cc. given in this manner was the smallest completely efficacious dose. The addition of a comparatively large dose of magnesium sulphate to the treatment completely protected animals against the toxic action of large doses of the drug, without in any way impairing its anthelminthic efficacy. Carbon-tetrachloride displayed no anthelminthic activity against nodular worms, *Œsophagostomum columbianum* or against *Ostertagia* or *Trichostrongylus*.

Tetrachlorethylene showed a variable efficacy against hookworms, ranging from 9.3 per cent. to 100 per cent. It is not likely to prove as useful as CCl_4 in the treatment of infestations in sheep.

Tetrachlorethane, pentachlorethane and trichlorethylene proved valueless owing to their extreme toxicity.

Hexachlorethane in one sample proved to have a high efficacy against hookworms; a second sample was considerably less active.

Sodium-trichloracetate, ethyl-trichloracetate and *para*-dichlorobenzene were of no value against hookworms, nodular worms or small *trichostrongyles*.

Copper sulphate and tobacco infusion, and turpentine and linseed oil failed to remove any hookworms, in spite of the fact that they are frequently recommended for this purpose.

The administration of oil of chenopodium to sheep intravenously is so dangerous that the method is impracticable as an anthelminthic measure.

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(II) CCL_4 alone Administered by Stomach Tube in Small Doses.

Case.	Weight in lbs.	Age in months.	Condition.	Dose and dose-rate per lb. body weight.	Worms Passed. 1st day.	2nd day.	3rd day.	4th day.	Total.	Worms collected *post-mortem*.		Efficacy. Against Hook-worms.	Against Other Species.
					Bunostomum.								
2613	20	4½	Anæmia Ascites.	4cc. @0.2cc.	11	94	89	1	195	B. trigonocephalum	18 living. 1 dead.	91.6%	0%
					Other Species.					H. contortus	10 living.		
										O. circumcincta	442 ,,		
					—	—	—	—	—	Trichostrongylus spp.	12 ,,		
										O. columbianum	6 ,,		
										Trichuris ovis	2 ,,		
					Bunostomum.								
2673	27	4	Poor.	5.4cc. @ 0.2cc.	0	139	0	0	139	† B. trigonocephalum	1 living.		
										H. contortus	0	97.5%	0%
					Other Species.					O. columbianum	1 living.		
					—	—	—	—	—	Trichuris ovis	1 ,,		
					Bunostomum.								
2559	25	8–9	Anæmic Emaciated Ascites.	5cc. @ 0.2cc.	19	720	24	0	763	‡ B. trigonocephalum	0		
										H. contortus	0		
					Other Species.					O. circumcincta	0	100%	0%
					—	—	—	—	—	Trichostrongylus spp.	3 living.		
										O. columbianum	2 ,,		
										Trichuris ovis	11 ,,		
					Bunostomum.								
2631	33	8–9	Poor. Anæmic. Already treated with CCL4.	6.6cc. @ 0.2cc.	0	1	0	0	1	B. trigonocephalum	0		
										H. contortus	0		
					Other Species.					O. columbianum	6 living.		
					—	—	—	—	—				

† Dull 2nd day to 6th day. Feeding poorly. Died night of 5th-6th day.

‡ Dull on 2nd day. Respirations and pulse normal. Died morning of 4th day.

(II) CCl_4 alone Administered by Stomach Tube in Small Doses—*continued.*

Case.	Weight in lbs.	Age in months.	Condition.	Dose and dose-rate per lb. body weight.	Worms Passed. 1st day.	2nd day.	3rd day.	4th day.	Total.	Worms collected *post-mortem*.		Efficacy. Against Hook-worms.	Against Other Species.
						Bunostomum.				B. trigonocephalum	0		
2594	29	8	Improving slightly.	4.35cc. @ 0.15cc.	5	72	12	0	89	H. contortus	0	98.9%	0%
										Trichostrongylus spp.	Several thousand.		
						Other Species.				O. columbianum	3 living.		
					—	—	—	—	—	Trichuris ovis	6 ,,		
						Bunostomum.					611 dead.		
2608	31	8–9	Emaciated Anæmic Ascites.	6.6cc. @ 0.15cc.	—	91	—	—	705	*§B. trigonocephalum	8 living.		
										H. contortus	0	98.9%	0%
						Other Species.				O. columbianum	13 living.		
					—	—	—	—	—	Trichuris ovis	6 ,,		
2595	30	8–9	Emaciated, improving.	3cc. @ 0.1cc.	—	—	—	—	—	‖B. trigonocephalum	132 living.		
										H. contortus	12 ,,		
										O. columbianum	9 ,,		
										O. circumcincta	723 ,,		
										Trichuris ovis	2 ,,		
						Bunostomum.				B. trigonocephalum	0		
2593	30	8–9	Emaciated. Anæmic Ascites.	3cc. @ 0.1cc.	18	132	347	63	560	H. contortus	0	100%	0%
						Other Species.				O. columbianum	7 living.		
					—	—	—	—	—	Trichuris ovis	32 ,,		
						Bunostomum.				B. trigonocephalum	0		
2597	29	8–9	Emaciated, improving.	2.9cc. @ 0.1cc.	—	81	63	15	159	H. contortus	0		
						Other Species.				O. columbianum	2 living.	100%	0%
					—	—	—	—	—	Trichuris ovis	7 ,,		
										O. circumcincta	817 ,,		
										Trichostrongylus spp. ca.	1,000 ,,		

* Including 611 dead hookworms in the contents of the large intestine *post-mortem*. § Found dead on morning of 2nd day. ‖ Died 24 hours after dosing.

(III) Small Doses of CCl_4 given by Capsule to large Sheep. No Purgative.

Case.	Weight in lbs.	Condition.	Dose and dose-rate per lb. body weight.	Worms Passed. 1st day.	2nd day.	3rd day.	4th day.	Total.	Worms collected *post-mortem*.		Efficacy. Against Hook-worms.	Against Avitel-lina.	Against Œsopha-gostomum.	Against Other Species.
						Bunostomum.								
2955	51	Good.	3cc.	0	3	23	0	26	B. trigonocephalum	0				
									H. contortus	4				
									O. columbianum	5	100%	0%	0%	0%
									Trichuris ovis	6				
									Cestodes	0				
						Bunostomum.								
2954	48	Good.	2cc.	0	21	34	0	55	B. trigonocephalum	6				
									H. contortus	0	90%	100%	0%	0%
									O. columbianum	19				
						Avitellina.								
				0	0	7	0	7	Avitellina	Two small fragments, partly digested.				
						Bunostomum.								
2953	48	Good.	1cc.	0	5	7	0	12	B. trigonocephalum	31				
									H. contortus	0				
									O. columbianum	9	26.1%	—	0%	0%
									Trichuris ovis	1				
									Cestodes	0				
						Bunostomum.								
2960	30	Good. Periodic diarrhœa.	3cc.	0	2	0	0	2	B. trigonocephalum	0				
									H. contortus	7	—	—	0%	0%
									O. columbianum	178				
						Bunostomum.								
A2	44	Poor. Periodic diarrhœa.	3cc.	0	0	0	0	0	B. trigonocephalum	0				
						Œs. columbianum.			H. contortus	6	—	—	3.8%	—
				0	0	0	3	3	O. columbianum	75				
						Bunostomum.								
A3	48	Good. Periodic diarrhœa.	3cc.	0	17	28	0	45	B. trigonocephalum	0				
						Œs. columbianum.			H. contortus	11	100%	—	0.2%	0%
				0	0	0	4	4	O. columbianum	213				
						Bunostomum.								
A5	44	Good. Periodic diarrhœa.	2cc.	0	11	2	0	13	B. trigonocephalum	4				
									H. contortus	7	76.5%	—	0%	0%
									O. columbianum	377				
						Bunostomum.								
A7	42	Good. Periodic diarrhœa.	2cc.	0	5	13	1	19	B. trigonocephalum	1				
									H. contortus	5	82.6%	—	0%	0%
									O. columbianum	134				

No symptoms were exhibited by any of these animals.

(IV) CCL_4 by Stomach Tube, followed Immediately by Magnesium Sulphate 3 ozs. in Saturated Solution.

Case.	Weight in lbs.	Age in months.	Condition.	Dose and dose-rate per lb. body weight.	Worms Passed. 1st day.	2nd day.	3rd day.	4th day.	Total.	Worms collected *post-mortem*.		Efficacy. Against Hook-worms.	Against Other Species.
						Bunostomum.							
2589	41	13–14	Fairly good. Already treated with CCL_4.	8.2cc. @ 0.2cc.	0	0	3	0	3	B. trigonocephalum	0		
										H. contortus	0		
						Other Species.				O. columbianum	7 living.		
					0	0	0	0	0	Trichuris ovis	3 ,,		
						Bunostomum.							
2591	37	15	Poor. Improving. Anæmic. Already treated with CCC_2 CCl_2.	7.4cc. @ 0.2cc.	0	0	279	4	283	B. trigonocephalum	5 living.		
										H. contortus	0	98.2%	0%
						Other Species.				O. columbianum	9 living.		
					0	0	0	0	0	Trichuris ovis	11 ,,		
						Bunostomum.							
2610	49	18	Poor. Anæmic. Improving slowly.	9.8cc. @ 0.2cc.	0	81	188	0	269	B. trigonocephalum	0		
										H. contortus	0	100%	0%
						Other Species.				O. circumcincta	198 living.		
					0	0	0	0	0	Trichuris ovis	3 ,,		
						Bunostomum.							
2609	47	12	Fair. Improving.	9.4cc. @ 0.2cc.	0	0	61	0	61	B. trigonocephalum	0		
										H. contortus	0		
						Other Species.				O. circumcincta	132 living.	100%	0%
					0	0	0	0	0	Trichostrongylus spp.	47 ,,		
										O. columbianum	0		
						Bunostomum.							
2602	24	8–9	Emaciated. Anæmic Ascites. Intermittent diarrhœa.	4.8cc. @ 0.2cc.	0	147	529	18	694	B. trigonocephalum	2 living.		
										H. contortus	5 ,,	99.7%	0%
						Other Species.				O. circumcincta	174 ,,		
					0	0	0	0	0	O. columbianum	6 ,,		
						Bunostomum.							
2622	20	4–5	Poor. Anæmic.	4cc. @ 0.2cc.	0	23	195	0	218	B. trigonocephalum	0		
										H. contortus	0	100%	0%
						Other Species.				O. columbianum	6 living.		
					0	0	0	0	0	Trichuris ovis	3 ,,		
						Bunostomum.							
2793	37	11–12	Fair.	3.2cc. @ 0.1cc.	0	3	28	5	36	B. trigonocephalum	0		
										H. contortus	6 living.	100%	0%
						Other Species.				O. columbianum	133 ,,		
					0	0	0	0	0	Trichuris ovis	2 ,,		

None of these animals exhibited any symptoms after treatment.

(IV) CCl_4 by Stomach Tube, followed Immediately by Magnesium Sulphate 3 ozs. in Saturated Solution—*cont.*

Case.	Weight in lbs.	Age in months.	Condition.	Dose and dose-rate per lb. body weight.	Worms Passed. 1st day.	2nd day.	3rd day.	4th day.	Total.	Worms collected *post-mortem*.		Efficacy. Against Hook-worms.	Against Other Species.
						Bunostomum.							
2605	32	7	Improving.	3.2cc. @ 0.1cc.	0	29	10	0	39	B. trigonocephalum	0		
										H. contortus	0		
						Other Species.				O. circumcincta	0	100%	—
						Ostertagia circumcincta.				O. columbianum	2 living.		
					0	1	0	1	2	Trichuris ovis	7 ,,		
						Bunostomum.							
2592	31	7-8	Anæmic.	3.1cc. @ 0.1cc.	0	202	7	0	209	B. trigonocephalum	0		
										H. contortus	0	100%	0%
						Other Species.				O. columbianum	2 living.		
					0	0	0	0	0	Trichuris ovis	9 ,,		
						Bunostomum.							
2600	30	5 6	Improving. Already treated with CCl_2 CCl_2.	3.0cc. @ 0.1cc.	0	0	5	0	5	B. trigonocephalum	0		
										H. contortus	0	100%	0%
						Other Species.				O. columbianum	3 living.		
					0	0	0	0	0	Trichuris ovis	2 ,,		
						Bunostomum.							
2611	32	15	Emaciated. Anæmic. Ascites.	3.2cc. @ 0.1cc.	0	97	627	19	743	B. trigonocephalum	0		
										H. contortus	5 living.	100%	0%
						Other Species.				O. columbianum	12 ,,		
					0	0	0	0	0	Trichuris ovis	9 ,,		
						Bunostomum.							
2601	33	15	Poor. Anæmic. Ascites.	3.3cc. @ 0.1cc.	0	243	81	0	327	B. trigonocephalum	0		
										H. contortus	0		
						Other Species.				O. columbianum	0	100%	0%
					0	0	0	0	0	O. circumcincta	82 living.		
						Bunostomum.							
2612	24	8-9	Emaciated. Anæmic. Ascites. Diarrhœa.	2.4cc. @ 0.4cc.	0	783	119	0	932	B. trigonocephalum	0		
										H. contortus	0	100%	0%
						Other Species.				O. circumcincta	726 living.		
					0	0	0	0	0	O. columbianum	5 ,,		
						Bunostomum.							
2624	24	8-9	Emaciated. Anæmic. Ascites.	2.4cc. @ 0.1cc.	0	287	139	3	429	B. trigonocephalum	0		
										H. contortus	0	100%	0%
						Other Species.				O. circumcincta	436 living.		
					0	0	0	0	0	O. columbianum	2 ,,		

None of these animals exhibited any symptoms after treatment.

(V) Tetrachlorethylene. C_2C_{14}

Case.	Weight in lbs.	Age in months.	Condition.	Dose and dose-rate per lb. body weight.	Worms Passed. 1st day.	2nd day.	3rd day.	4th day.	Total.	Worms collected *post-mortem*.		Efficacy. Against Hook-worms.	Against Hæmonchus.	Against Œsophagostoma.
					Bunostomum.									
2969	30		Poor. Diarrhœa.	3cc. @ 0.1cc. by capsule.	0	0	0	0	0	B. trigonocephalum	2*			
										H. contortus	7			
										O. columbianum	178	0%		.6%
					Œsophagostomum.									
					0	1	0	0	1					
					Bunostomum.									
A2	44		Poor. Diarrhœa.	4.4cc. @ @ 0.1cc. by tube with $MgSO_4$.	4	1	0	0	5	B. trigonocephalum	0	100%	14.3%	
										H. contortus	6			
					Hæmonchus contortus.					O. columbianum	78†			
					1	0	0	0	1					
					Bunostomum.									
2591	37	15	Poor. Improving.	3.7cc. @ @ 0.1cc. by capsule.	0	17	13	3	33	B. trigonocephalum	288‡			
										H. contortus	0			
										O. columbianum	9	10.3%		
										Trichuris ovis	11			
					Bunostomum.									
2600	30	5	Improving slowly.	6cc. @ 0.2cc. by tube with $MgSO_4$.	0	22	76	0	98	B. trigonocephalum	5§			
										H. contortus	5			
										O. columbianum	12	95.1%		
										Trichuris ovis	9			

None of these animals exhibited any symptoms after treatment.

* Both removed by CCL_4. † 3 removed by CCL_4. ‡ 283 removed by CCL_4, see Table III. § All removed by CCL_4.

(V) Tetrachlorethylene. C_2C_{14}—*continued.*

Case.	Weight in lbs.	Age in months.	Condition.	Dose and dose-rate per lb. body weight.	Worms Passed. 1st day.	2nd day.	3rd day.	4th day.	Total.	Worms collected *post-mortem*.		Efficacy. Against Hook-worms.	Against Hæmonchus.	Against Œsophagostoma.
						Bunostomum.								
2793	37	16	Poor.	2cc. @ 0.05cc. by capsule.	0	0	0	0	0					
						Hæmonchus contortus.								
					24	0	0	0	24	B. trigonocephalum	36			
						Œsophagostomum.				H. contortus	7	0%	77.4%	12.5%
					3	0	16	0	19	O. columbianum	133			
						Bunostomum.								
A4	45		Fair. Diarrhœa.	9cc. @ 0.02cc. by tube with $MgSO_4$.	0	3	14	0	17	B. trigonocephalum	11			
										H. contortus	7	67.2%		
										O. columbianum	237			
						Bunostomum.								
A6	44		Fair. Diarrhœa.	8.8cc. @ 0.2cc.	0	7	3	0	10	B. trigonocephalum	6			
										H. contortus	9	62.5%		
										O. columbianum	137			
										Trichuris ovis	3			
						Bunostomum.								
A11	34		Poor.	6.8cc. @ 0.2cc. by tube with $MgSO_4$.	0	9	7	2	18	B. trigonocephalum	178			
										H. contortus	11	9.2%		
										O. columbianum	2			
										Trichuris ovis	13			
						Bunostomum.								
A12	36		Poor. Diarrhœa.	7.2cc. @ 0.2cc. by tube with $MgSO_4$.	0	32	27	15	74	B. trigonocephalum	329			
										H. contortus	0	18.4%		
										O. columbianum	11			
										Trichuris ovis	6			

None of these animals exhibited any symptoms after treatment.

(VI). Hexechlorethane. C_2C_{16}

Case.	Weight in lbs.	Age in months.	Condition.	Dose and dose-rate per lb. body weight.	Worms Passed. 1st day.	2nd day.	3rd day.	4th day.	Total.	Worms collected *post-mortem*.		Efficacy. Against Hook-worms.	Against Other Species.
					Bunostomum.								
2603	24	8-9	Anæmic. Emaciated.	6 grams @ 0.25 gr. in hard gelatine capsule.	7	44	131	42	524	*B. trigonocephalum	2		
										H. contortus	9		
										O. circumcincta	576	99.6%	0%
										O. columbianum	1		
										Trichuris ovis	7		
					Bunostomum.								
2590	33	14	Poor. Anæmic. Occasional Diarrhœa.	4 grams @ 0.125.	0	11	154	16	181	B. trigonocephalum	402		
										H. contortus	0		
										O. circumcincta	132	31%	0%
										O. columbianum	13		
										Trichuris ovis	10		
					Bunostomum.								
2605	34	14	Poor. Anæmic.	4 grams @ 0.125	0	261	59	7	327	B. trigonocephalum	306		
										H. contortus	1		
										O. circumcincta	39	51.7%	0%
										O. columbianum	7		
										Trichuris ovis			
					Bunostomum.								
2611	32	15	Emaciated & Anæmic. Marked Ascites.	2 grams @ 0.0625	0	15	1	0	16	B. trigonocephalum	743†		
										H. contortus	5		
										O. columbianum	12	2.1%	0%
										Trichuris ovis	9		

* No symptoms 1st day. Slightly dull 2nd day. P.-M.—Area inflamed mucous membrane, cardiac-end of abomasum, equal to size of palm of hand. No erosion of membrane, but numerous petechiæ. No other lesions.

† All removed by CC14.

(VI) Hexechlorethane C_2C_{16}—*continued.*

Case.	Weight in lbs.	Age in months.	Condition.	Dose and dose-rate per lb. body weight.	Worms Passed. 1st day.	2nd day.	3rd day.	4th day.	Total.	Worms collected *post-mortem*.		Efficacy. Against Hook-worms.	Against Other Species.
						Bunostomum.							
2909	61		Good.	15 grams @ 0.25.	0	9	5	0	14	B. trigonocephalum	41		
										H. contortus	5	25.5%	0%
										O. columbianum	8		
										Trichuris ovis	0		
						Bunostomum.							
2910	38		Fairly good.	10 grams @ 0.25	0	3	0	0	3	B. trigonocephalum	4		
										H. contortus	21	57.1%	0%
										O. columbianum	5		
						Bunostomum.							
2906	70		Good.	18 grams @ 0.25.	0	0	0	0	0	H. contortus	6		0%
										O. columbianum	3		
						Bunostomum.							
2908	39		Good.	10 grams @ 0.25	1	2	0	0	3	B. trigonocephalum	0		
										H. contortus	3		
										Trichostrongylus spp.	4	100%	0%
										O. columbianum	3		
										Trichuris ovis	1		
						Bunostomum.							
2907	58		Good.	15 grams @ 0.25	0	2	1	0	3	B. trigonocephalum	2	60%	0%
										H. contortus	14		
						Bunostomum.							
2905	47		Good.	12 grams @ 0.25	0	1	1	0	2	B. trigonocephalum	1		
										H. contortus	13	66.7%	0%
										O. columbianum	11		
										Trichuris ovis	2		

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A NOTE ON THE TOXICITY OF AN AQUEOUS EXTRACT OF BAMBOO SHOOTS (N.O. GRAMINEÆ—BAMBOSA ARUNDINACEÆ).

By M. K. GARUDACHAR, G.B.V.C.,

Member of the Bombay C.V.D., now undergoing Post Graduate Course, Royal (Dick) Veterinary College, Edinburgh.

Introduction.

In India one hears from time to time of cases of animals having died after feeding on Graminaceous plants, such as " Jawari " (Sorghum Vulgare) either when the plant is very young or has a stunted growth. In the present article the writer wishes to record the results of his research regarding the poisonous character of an aqueous extract of Bamboo shoots—one of the species of Gramineæ.

History.

Somewhat parallel to the West Coast of Peninsular India there extends a range of mountains by name " Sahyadri " from the neighbourhood of Khandala to Coorg. The valleys of these mountains are the " High " forest areas. That portion of this tract which belongs to the Bombay Presidency is called " Kokan " consisting of four districts, Thana, Ratnageri, Kolaba and Kanara. Bamboo grows very luxuriantly in the forest of these districts. Some time ago when the writer was in one of these districts—Kanara—he conducted a general survey of the conditions of cattle husbandry in his area, and of the diseases of cattle.

Casually he was told that cattle in his area sometimes die, after consuming " Kalale Neeru." The farmers of this area freely use Bamboo shoots for their own consumption and know how to prepare them for food purposes. They get the young and tender shoots, cut into very fine pieces—as fine as a grain—macerate them for 4 days, decant all water, wash the stuff well several times and then cook. The decanted fluid extract they call " Kalale Neeru." They said if such water by chance be drunk by cattle or any animals they would surely die. Further they affirmed that if cattle ate fresh shoots in the jungle, they would not die (Evans has recorded that elephants in Burma eat Bamboo shoots). Moreover they have a classical treatment for it, too, written out by a " Jain " physician who was said to have lived in the latter part of the 18th Century in the Kingdom of " Swadi " (Kanara).

Being much interested in what the farmers said, the writer instituted further inquiries and now desires to record the results of his observations.

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Experiments.

Some bamboo shoots were collected and sent to Dr. H. H. Mann, the then Chemical Analyser to the Government of Bombay (1916). Dr. Mann, however, could not conduct any analysis that year as materials sent were insufficient for the purpose, and so the question was postponed, as such shoots appear only once in a year, i.e. during the rainy season (June to November).

Next year (1917) shoots were sent again to Dr. Mann. He conducted the analysis :

To quote his own reply :—

" We examined the liquid obtained for any minerals or vegetable poison we could find, anything including alkaloids, but we failed to discover any of these. Hydrocyanic acid which I thought possible, is absent. No alkaloid can be detected. I then proceeded to try the material on rabbits which I keep for experimental purposes, and on goats. In neither case could I get any reaction whatever on the part of the animals. In the case of the goat no less than 150 cc. of the extract equivalent to 125 grams of the pulp was given as a drench but no bad effects could be detected."

Subsequent inquiries and experiments showed why the administration of the material failed to induce symptoms of poisoning in his early experiments. The shoots were neither finely cut nor allowed to stand for some time ; but were made only into a pulp and immediately administered.

Fresh bamboo shoots were obtained again by the writer, cut into small grains by expert cooks, soaked in water for 3 days and on the 4th day the supernatant liquid was drawn off and administered to a sheep, age three years. A dose of 300 cc. of this water was given at 8.30 a.m.

Symptoms noticed were as follows :—

8.40. Dullness. Temperature normal.

8.48. Roached back ; quick pulse. Temp. normal.

9.0. Loss of equilibrium. Resting muzzle on the floor ; pulse quick, laboured breathing. Nostrils dilated. Temp. fall by two degrees F.

9.20. Prostration. Neck turned to one side. Limbs stretched. Clonic spasms of the muscles of the neck and limbs. Grinding of the teeth, audible from a distance of 12 feet. Pulse wiry. Breathing imperceptible. Temp. fall by two degrees F.

10.0. The animal was on the point of death.

Since the owner of the sheep was not willing to submit the animal for *post-mortem* the writer had to wait for some other opportunity to record his observation.

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These observations were communicated to Dr. Mann. He was also supplied again with bamboo shoots, together with some of the watery extract of the bamboo shoots used by the writer for his experiment. Clear instructions were also given how to prepare an extract out of it. Dr. Mann then had an experiment carried out in the Agricultural College Hospital by Mr. B. B. Joshi, G.B.V.C., Veterinary Surgeon in Charge of the Hospital, and Lecturer in Veterinary Science. In this case 300 cc. of the extract was given to a goat, 4 months old. The animal showed all the symptoms noticed by the writer but death occurred earlier, in 15 minutes only.

Post-Mortem.

Congestion of the central nervous system and the lungs was marked. Heart contained bubbles of gas. Rumen slightly inflamed; other organs normal. (B. B. Joshi.)

This solution was chemically analysed and it gave a distinct reaction to the test for Hydrocyanic acid. (Dr. Mann.)

When the cause of this " Kalale Neeru " poisoning was now definitely known, the writer attempted to treat cases quite rationally. Unfortunately or fortunately he did not get more than three chances during his 10 years' practice. One was a buffalo calf, (2) a heifer, and (3) a bull.

On the first neither ferrous hydrate nor atropine sulphate had any effect. In the second and third cases it was too late to drench; so atropine sulphate was tried, but with no effect.

Post-mortems were held on these animals. All showed the typical changes of hydrocyanic poisoning.

Classical Treatment.

It may not be out of place here if the writer notes the classical treatment which has been in use for many years. (In India almost every village has some quack to treat patients—civil or veterinary.) An artificial deep ring is made out of cow-dung between the base of the horns and then this cavity is filled to the top with boiling oil and allowed to remain till the animal shakes his head. (He may even die without shaking the head !)

Internally, if the case is immediately noticed, a large quantity of butter-milk is given.

Summary.

(1) Bamboo shoots contain 0.023 per cent. of hydrocyanic acid.
(2) All parts of shoots are not equally harmful and probably the brownish tips are the most dangerous. (Dr. Mann.)
(3) To get the effect the shoots must be finely cut for the Extract.

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(4) The hydrocyanic acid does not appear in quantity till after the third day of soaking in water (" Kalale Neeru.")

(5) Treatment is practically impossible as it would be too late by the time the Veterinarian could arrive.

If at all any credit is to be given to native treatment, it might be due to sub-lethal dose, i.e. small dose of poison.

The writer is much indebted to Dr. H. H. Mann and Prof. Sahasrabuddhe for their kind co-operation in conducting this investigation, and to Colonel G. K. Walker, the then Superintendent, Civil Veterinary Dept., for affording ample facilities for this purpose.

Finally he wishes to express his thanks to Professor D. C. Matheson of the Department of Pathology and Bacteriology, Royal (Dick) Veterinary College, Edinburgh, for his kind assistance in preparing this note for the Press.

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Clinical Articles

Obstruction of the Small Intestine.

By MR. R. HUDSON, F.R.C.V.S.,
Retford.

A SEQUENCE of cases of obstruction of the bowel caused me to look up various authors who had dealt with the matter, and I was surprised when reading Reek's book on " Colic," to find that he had never seen obstruction of the small intestine, though he thought that it sometimes did happen but was relieved.

During a number of cases which have been of an unusual type, I have had three cases in which obstruction of the small intestine has existed.

In one case it was unattended with any other condition, but in the other two the one had impaction of the stomach, and the other had a large quantity of food in the beginning of the double colon, though it might not have originated an obstruction if the secretion from the small intestine had been able to reach it.

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In the case with impaction of the stomach the obstruction in the small intestine occurred about 2 feet from the pylorus, and was about 2½ feet in length, but in the other case the obstruction was in the last two feet of iteun, and it appeared as though the ingesta had packed at the ilio-cæcal valve.

The obstruction consisted of badly masticated chopped straw and coarse wiry grass.

In two cases the mucous membrane had become dry and parchment like.

The symptoms were rather unusual. Pain was of the subacute type.

Pulse : had a tendency to become rapid (95 to 125) at an early stage.

Temp. : kept low, being about 101.6 to 103.

Tympany : at the outset there was a general fullness of the abdomen, but this subsided and the flanks later became hollow.

Internally one could feel coils of inflated small intestine.

Two cases had eructations of gases from the stomach.

Conjunctiva was early in the case a bad colour which increased as the case progressed. Duration of the illness was about 48 hours.

Passage of Fæces occurred in small quantity during the latter part of the time, and pain subsided but the pulse became worse.

Quivering of the Muscles—a bad sign—was present early and grew worse as the case progressed.

Sweating : was less pronounced than in the usual " colic " case, but the ears, body and extremities were cold and clammy.

Anything diagnostic during life is rather difficult to express, but I was able from similarity of symptoms to diagnose the condition.

Causes : the cases have occurred during a spell of exceptionally dry and hot weather. Pastures and the usual straw chop being exceptionally dry and hard.

The hot weather would naturally tend to greater exhaustion at work, and thirst. I am inclined to think that delayed food passing along the intestine may have been washed along in bulk to the ilio-cæcal valve, and this meeting with a constricted opening becomes arrested.

Treatment : For the usual case of intestinal obstruction, I have preferred to use aloes, with ammonium carbonate and Nux Vomica ; sometimes assisted by eserine or arecoline ; and this after a fair trial of other methods including stomach injection of saline and formalin.

Injection of large quantities of fluid would appear ideal in such cases, for one would think that they would liquefy the mass ; but they do not. In fact they appear to wash out mucus and leave the contents like washed straw.

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In cases where I have performed a *post-mortem* examination, I have found the two had abundance of fluid in the stomach and in parts of the small intestine. I am inclined to think that it had not reached the obstructing mass.

Both cases had been allowed to sip small quantities (about half a gallon) of tepid water, which had rested in the stomach and early part of the small intestine.

Milk Fever.

By MR. R. HUDSON, F.R.C.V.S.,
Retford.

At the time when the etiology of milk fever is being so much discussed, the following case may be of interest in that it disregards some of the conditions which are usually thought to be vital to the production of the disease.

The cow was a cross-bred Friesian which had had five calves and carrying her sixth. On January 19th, 1926, she calved and went down with milk fever, recovering in a few hours. On September 29th, 1928, she calved again and missed an attack.

About November, 1928, she reached her maximum milk yield, viz. 7½ to 8 gallons daily.

During March, 1929, she was giving just over six gallons daily.

She had been milked three times daily since a month after calving. (October, 1928.)

She had received 3 lbs. concentrates per gallon of milk with 3 lbs. maintenance ration with 30 lbs. swedes, at three meals per diem. Animal was in medium condition.

On March 13th, she went down with milk fever. A typical attack recovering after the injection of air in five hours.

Inquiry with regard to feeding, watering, milking failed to show anything which might have led to an increased milk yield.

Careful examination failed to reveal any condition which might produce the symptoms of semi-coma apart from milk fever.

Aneurism in the Cow.

By U. F. POLLOCK, M.R.C.V.S.,
Lismore, New South Wales.

At a recent *post-mortem* examination near Murwillumbah, New South Wales, which I witnessed on behalf of the Department of Agriculture, an interesting pathological condition was revealed.

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A dairy cow had collapsed when yarded for milking and died after a short period of struggling. Having been dipped on the previous day, the owner suspected the treatment of having occasioned its unexpected demise, and called in Mr. Bowker, M.R.C.V.S., to determine the cause of death.

On the abdominal cavity being emptied of viscera, masses of congealed blood were disclosed, one clot rivalling the beast's liver in size. They were apparently of recent formation. Further exploration revealed an aneurism adjoining the posterior aorta in the region of the kidneys. It was about the size of a medium cocoanut, and contained in its lower cavity a considerable quantity of organised blood clot.

The owner said that nothing untoward in the cow's behaviour had attracted attention until the recent occurrence now described with its fatal termination.

Being a unique specimen, I passed it on to Dr. H. R. Seddon, D.V.Sc., for preservation at Glenfield Veterinary Research Station.

Precocity of Reproduction of Bovines.

By U. F. POLLOCK, M.R.C.V.S.,
Lismore, New South Wales.

CALLED to a holding near Murwillumbah, New South Wales, recently, I was confronted with the spectacle of a diminutive cow bailed up for milking. She was of mongrel-Jersey strain and aged between twelve and thirteen months. Her calf had died, but she had sprung quite a respectably-sized bag and was being regularly milked.

I mentioned the fact to a local resident later and he informed me that a similar experience had befallen a thirteen months' old Jersey heifer in his own herd, the serving bull being a beast of eight to nine hundredweight.

Some owners hold the view that Jerseys as a breed are prone to exceptionally early impregnation, but gestation at such an early stage is, I fancy, rather unique.

A Foreign Body Causes Hiccough in Puppy.

By PHILIP VINCENT, M.R.C.V.S.,
Hove.

EARLY in the morning of the 20th November last, I was called in to see a Sealyham terrier puppy, eight months old.

The puppy had been suffering with hiccough the whole of the preceding night. When I saw him the spasms were very violent and

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frequent; temperature 102°; considerable abdominal pain; anxious expression; flatulency; and constipation. In the evening of this day there was no appearance of relief.

The following morning the spasms were not so violent, but the puppy was rather exhausted, and had vomited twice during the night.

In the evening a hard piece of fæces was evacuated, and four hours later another impaction of a semi-fluid nature, and which contained a piece of string, rather thick, 15 inches long, and knotted in two places. The hiccough immediately ceased, and the following day the patient was, excepting for a little weakness, quite himself again. The following treatment was adopted. Liq. paraffin, ol. tereh., sod. bicarb., hyg. subchlor., ol. ricini, with enema of glycerine and warm water.

Translations

Sacral Anæsthesia and Colic Treatment.

By DR. MEYER,
*of Lüneburg.**

WHILST in cattle practice sacral anæsthesia is frequently employed one hears little about its use in the horse. In the horse paralysis of the hind extremities leads to bad accompanying symptoms. I have brought some of these cases to a successful issue in restless and unruly patients by producing narcosis by intestinal tamponing with chloral hydrate. On one occasion I had no chloral hydrate with me, and employed sacral anæsthesia. The case is instructive and interesting. The patient was a nervous thoroughbred and had been ill with colic in a loose box for several hours. Restlessness was almost continuous and only short intervals of ease. Slight sweating, pulse quick but strong, mucous membranes of the eyelids injected, slight meteorismis, intestinal movements discernible. On rectal examination one felt a tympanitic loop of large intestine, stoppages or displacement not found. There was thready tenacious mucus in the intestine and dilation of the large intestine. The intestinal tampon is very useful in this kind of colic but with a nervous horse is very difficult. For this reason I injected 15 ccm. of a 1 per cent. tutocain solution into the space between the first and second coccygeal vertebræ. After a few minutes the horse got up and the pain diminished. After 8 minutes the horse showed no further signs of colic. The anus now offered no resistance

* *Berliner Tierarzt, Woch.*

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to the introduction of the tamponator. Following the passing in of 13 gallons of physiological salt solution, the horse did not strain once. Gases escaped through the tube. The body was distended after the infusion, but the subject showed no signs of pain. After 2 hours fluid and pultaceous fœces came away and the horse recovered.

I have recently injected 10 to 15 ccm. of tutocain solution in several colic cases and it facilitates the introduction of the tamponator and enables much fluid to be sent far up into the intestine because the horse does not strain against it. In performing embryotomy on a Hannover mare I injected 40 ccm. of a 1 per cent. solution of tutocain which suppressed the straining and caused the mare to stand up during the operation.

As regards the technic. One finds the place for injection by lifting the tail horizontally with the right hand and moving it to and fro laterally and sliding the fore finger of the left hand along the top of the tail one finds the depression between the first (firm) and second (movable) coccygeal vertebra. Here the hair is shaved, iodised, and cut obliquely before injection. The vertebral canal is not much deeper than in the cow, 3 to 6 centimetres. Sacral anæsthesia presents no difficulty in the horse and it carries us a step further in the fight against quackery.

Abstracts of Current Literature

Goerttler, Dr. V., and Munster, F.—Animal Bone in Fishmeal.—*Berliner Tierarzt Woch, No. 48, November 29th,* 1929.

Skins containing anthrax bacilli have caused anthrax in cattle in Germany and feeding meals and especially fish meal has caused outbreaks of anthrax among swine. These two investigators have been for some time examining fish meal for the presence of animal bone and as to its purity. They come to the following conclusions: In the examination of fish meals for adulteration by the addition of flesh or bone meal coming from warm blooded animals it suffices to prove the presence of elements of mammalian bone. In fish bones as opposed to the bones of mammals there may be no Haversian canal system, almost always no bone cavities, bone canals nor bone canal system. There is a finer structure of the bones which can be seen and recognised in thin sections or small particles. Form, size and disposition of bone cavities furnish the most important distinctions. In fish bone cavities are represented generally by more or less spindle shaped, flat edged leaf-like structures of varying size. Only in some kinds of fish

and also only in a few bones of these one finds bone cavities with offshoots whose number as a rule is very small. There are always far more offshoots of bone cavities in mammals—naturally a great distinction—and the offshoots of bone cavities when they occur in fish simulate ganglion cells. When examined under the oil immersion lens there are no bone cavities in fish comparable to those in mammalian bone. The disposition of the Haversian canals in fish cannot be recognised in small particles of bone. Under the oil immersion lens and with the examination of small flakes of bone diagnosis is certain.

Frei, Prof. Dr. W.—Thyroid Gland: Iodine and Procreation.—*Schweizer Archiv fur Tierheilkirde.*

Dr. Frei, of Zurich, has been making investigations into the effect of iodine on sterility, growth in calves, and milk secretion in cattle. He considers that the aetiology and prophylaxis of untruitfulness of cattle is much concerned with the state of the thyroid gland and the amount of iodine in the food. Failure of iodine of the soil and vegetation cause anomaly of function of the thyroid (hypothyreosis) and in this way also directly harmful effect on procreative ability.

By administration of iodine to pregnant animals the functions of thyroid and also procreation can be restored to normal and lack of vitality in the young be considerably improved.

In swine iodine in the food causes increased fruitfulness. In certain circumstances iodine given to the nursing mother or to the young directly favours the growth of the latter.

The milk of every normal cow and goat contains iodine, the colostral milk considerably more than that in the further course of lactation. By giving iodine the amount secreted through the gland can be increased. By the use of suitable doses, at least under certain circumstances, milk flow may be increased. Potassium or sodium iodide have been the salts chiefly used in the numerous records and examples that the doctor gives.

Reviews

Manual of External Parasites. By Dr. H. E. Ewing. Pp. xiv+225; illustrations, 96 text figs. London: Baillière, Tindall & Cox. Price 20/- nett. Postage: Inland 6d.; Abroad 7d.

A short notice of this book appeared in our December issue and we now publish a more extended criticism of it.

Under the heading of "External Parasites," the author deals with that large class of insects and other arthropods which live as parasites on the bodies of animals and man, or harbour in the clothes of the latter. These comprise five main groups, and include the mites which belong to

the order Acarina and the ticks of the order Ixodioidea, both of the class Arachnida ; the biting lice of the order Mallophaga, the suckling lice of the order Anoplura and the fleas of the order Siphonaptera, the last three belonging to the class Insecta. Taken altogether, these creatures form a very formidable army of foes to man and his domestic animals, not to mention the rest of the animal world, so that a book covering the subject outlining the main classifications and describing the chief offenders cannot fail to be of the greatest practical utility.

Although it is only intended as a manual, and the classification of some of the groups is not extended as far as we could have wished, it is so extremely well illustrated that the student cannot but receive very great help in his study.

It is particularly valuable for the student of veterinary medicine in that it deals specifically with the best means of exterminating the various parasites, especially the lice and tick variety, which as every practitioner knows—whether he practises privately or holds some inspectorship as a county or borough official—give an infinity of trouble and frequently do irremediable damage to their host.

The name and source of information of its author is sufficient guarantee of the stability of the work for the Bureau of Entomology of the United States is a hall-mark in itself.

The Appendix is likely to prove of especial value on account of the fact that it gives descriptions of a considerable number of new genera, many of which appear in official print for the first time. Some of these might perhaps have been classified a little further, although to have done this in full detail would have very considerably added to the size of the volume.

The illustrations are excellent, and this again makes it of especial value as a text book for the student learner.

The Publishers have done their part well and, for that reason, the illustrations are the more valuable as they are clear in every detail.

Allgemeine Pathologie für Tierärzte. Sixth revised edition. By Theodore Kitt, M.D., Professor of Veterinary Medicine of Munich. Stuttgart : Ferdinand Enke. 1929. Pp. 582—213 figs. in the text ; 4 coloured plates. Price 42 marks ; bound 45 marks.

This revised edition of a standard German text book has been produced by the well-known author, Theodore Kitt, at the age of 70 and is dedicated to his dear wife. It appears at the time of his retirement from the Veterinary Faculty of Munich. The work is full of precise facts gathered during a long life of earnest application and endeavour. It is beautifully illustrated and the four coloured plates are very noteworthy. The descriptive text has been made shorter and simpler than in previous editions and many chapters have been re-written, added to and condensed without any sacrifice of exact information. There is an excellent bibliography at the end of most sections and the index is full and helpful. The sections on *avit mimosis* and *tuberculosis* are very interesting as are also the illustrations of *cancer* in the rat.

We are pleased to note that 18 pages are devoted to the nervous, motor and psychic troubles of animals.

The book may be warmly recommended and the publishers much commended for their part in the work.

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Handbuch der Geflügelkrankheiten und der Geflügelzucht. By Dr. T. v. HEELSBERGEN, Bacteriologist to the Veterinary Medicine Faculty of the University of Utrecht, with the following collaborators: Dr. E. Baudet (Utrecht), Dr. B. Te Hennepe (Rotterdam), Dr. H. Hoogland (Utrecht), Dr. B. Krijgsman, Buitenzorg (Java), Dr. G. Plank (Utrecht), Dr. Veenen Daal (Utrecht), and Dr. H. Vermeulen (Utrecht). 1929. Pp. 582, with 350 figures (some coloured) in the text. Price 45 R.M.; bound 48 R.M. Stuttgart: Ferdinand Enke.

THIS book has a frontispiece containing well executed prints of Leeuwenhoek, Jenner, Pasteur and Koch. As a work on fowl diseases it must take first place and the more one examines it the more one is impressed with the wonderful mine of information there is in it, and with the fact that those who can read German must find in it a very reliable, full and wise preceptor. There is a foreword to the volume by two such men of note in poultry disease investigations as Professor de Blieck and Professor Dr. H. Jakob. The anatomy and physiology of the fowl, p.m. technique, feeding and nutrition deficiencies, breeding, hygiene and all the numerous diseases of fowls and *post-mortem* appearances are fully described and the illustrations in the text, many of which are original, and from Professor de Blieck's collection, add lustre and ever wakeful interest to the letterpress. Perhaps two of the most valuable chapters in the book are those on "Infectious Diseases" and "Parasitic Diseases." With regard to the former the clinician will be thankful for the lucid descriptions and microscopic illustrations of typhus, cholera and bacillary white diarrhœa and he will recognise that the differentiation of them on *post-mortem* is made considerably plainer. Very interesting are the chapters on spirochætosis, plasmodiosis and coccidiosis. The more one delves into poultry pathology the more one is convinced that a big and wide field that ought to come under the purview of public health consideration is being overlooked. Men, cattle and swine can all be affected with the avian type of tubercle bacillus and as regards pigs we think this is often the case. As time goes on we opine that far more attention will be given by Veterinarians to the diseases of poultry and at the present time its importance is indicated by quite recent works on the subject emanating from France, Germany and America. But despite this great awakening we have neither seen nor read a better book than the one under review.

G.M.

Correspondence

To the Editor of THE VETERINARY JOURNAL, LONDON.

SIR,

The article on "Acute Eczema in Cattle," contributed by Mr. J. W. Hall Masheter to September's journal, recalls several cases encountered by me during the preceding twelve months.

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The least involved was the case of a pedigree Guernsey, where large patches of white skin over loins and withers were raised, reddened, somewhat hot and painful. Two other separate cases were more characteristic.

One was a yearling heifer of mixed breed, with areas of white skin on either shoulder and hip. These were markedly affected with a dermatitis, hair having been cast, leaving the skin scaly or encrusted with thick granulations. These lesions faithfully followed the meanderings of unpigmented skin, leaving the coloured portion quite untouched.

Another case was that of a milking cow of Shorthorn strain. A severe Dermatitis was in evidence, affecting white patches of skin on various aspects of the body. The shoulder, hip, flank and udder regions were involved more or less severely. Affected parts were encrusted and fissured and portions of skin were in process of sloughing or had been cast off with hair still attached. The teats were markedly affected, the skin being hard, dry, dark-coloured, fissuring and sloughing. In no case were pigmented portions of the skin involved. The owner informed me that the beast had been similarly affected the previous Spring.

From what I could gather, a constitutional reaction accompanied the onset of the condition, milk yield being considerably diminished during its course.

These cases were attributed to a condition of Photo-Sensitization, the sensitizing agent being of vegetable origin.

Certain members of Leguminosæ have been definitely proved to cause the condition amongst sheep in New South Wales, but, to my knowledge, no plant has been similarly identified in the case of cattle.

Yours, etc.,

U. F. POLLOCK,

Government Veterinary Surgeon, Department of Agriculture, New South Wales.

Box A54, Post Office,
Lismore, N.S.W., Australia.

4th December, 1929.

Notices

History of Veterinary Literature, Volume 3.

Owing to pressure on space section 7 of the above book, which is being issued as a supplement to the VETERINARY JOURNAL, has been unavoidably held over till February.

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Pass Lists.—University of London, December, 1929.

PRELIMINARY EXAMINATIONS IN VETERINARY SCIENCE.

Eric Benson Ince, Royal Veterinary College and Birkbeck College.

INTERMEDIATE EXAMINATIONS IN VETERINARY SCIENCE.

Samuel Leslie Hignett, Royal Veterinary College.

Gajanon Ponde, Royal Veterinary College.

PASS LIST.

John Henry Newbold Hobday, Royal Veterinary College.

Thomas Whyte Stobs, University of Glasgow and Royal Veterinary College.

Percival Stuart Watts, Royal Veterinary College.

B.SC.'S (VETERINARY SCIENCE).

PASS LIST.

Norman Henry Hole, Royal Veterinary College.

Eric Oliver Longley, Royal Veterinary College.

John Bede Polding, Royal Veterinary College.

Personal

MR. C. P. DOWNES, M.R.C.V.S., D.V.S.M., has been appointed Veterinary Officer to Uganda.

Publishers' Notices

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24 Feb'30
LIBRARY

All communications should be addressed to 7 & 8, Henrietta Street, Covent Garden, London, W.C 2. Telephone: Gerrard 4646. Telegrams: "Baillière, Rand, London."

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